DRAFT Memorandum

To: *Sean Sheldrake, US Environmental Protection Agency Region 10*

From: *CDM Smith*

Date: *April 15, 2019*

Subject: *Deposition in Sediment Management Areas and Updated Remedial Action Level Curves*

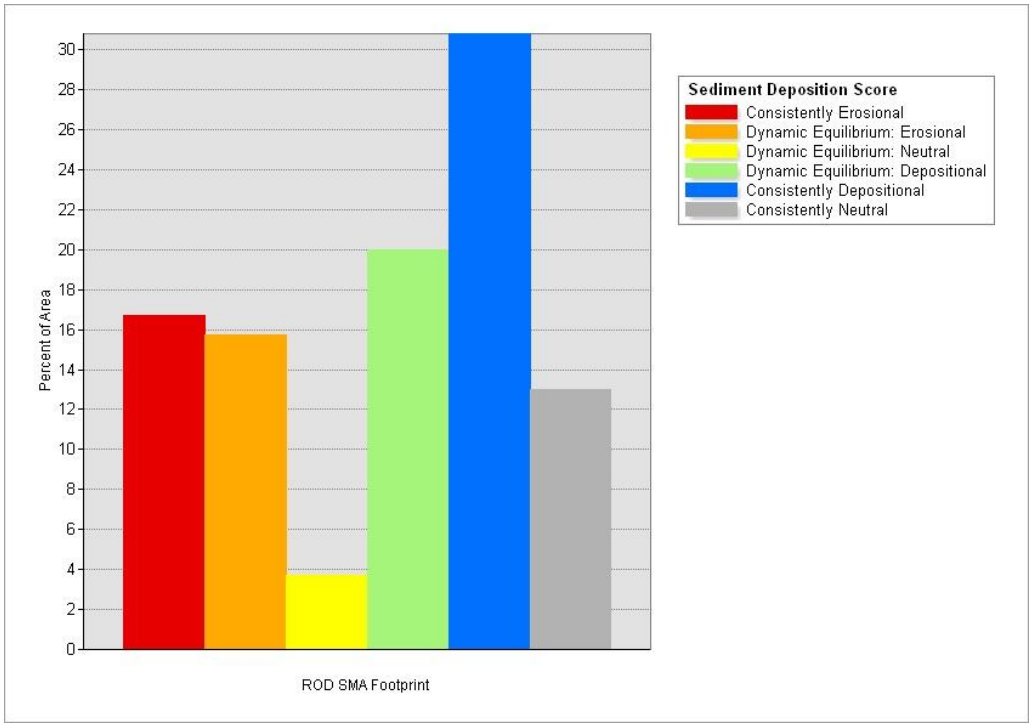
Introduction

The lower Willamette River, which encompasses the Portland Harbor Superfund Site (Site), is a dynamic river system that experiences episodic deposition and erosion over a range of spatial and temporal scales. Although the Site is net depositional, sediment is not deposited uniformly and some areas are net erosional or in "dynamic equilibrium" and subject to periods of oscillating deposition and erosion. It is therefore important to consider the patterns of deposition and erosion over long time-scales. The sediment management areas (SMAs) identified in the Record of Decision (ROD) receive less sediment deposition than the Site and are more erosional or dynamic. Combined with the high concentrations of the focused contaminants of concern (COCs), the ROD SMAs are resistant to natural recovery and require active remediation. Results from the 2018 bathymetry survey and surface sediment sampling are evaluated for their impact on the SMAs and remedial action levels (RALs) defined in the ROD.

Deposition in Sediment Management Areas

Bathymetry surveys during the Remedial Investigation (RI) were completed in 2002, 2003, 2004, and 2009 with the most recent survey completed in 2018 as part of the Pre-Design Investigation (PDI). These surveys are conducted to measure the sediment bed elevations. By comparing the various surveys over time, a picture of long-term river dynamics can be developed that shows whether an area is consistently depositional, consistently erosional, consistently neutral, or in dynamic equilibrium. **Figures 1a** and **1b** show the distribution of these areas in the ROD SMA footprints and the remainder of the Site area (i.e., outside of the active remediation area).

a)



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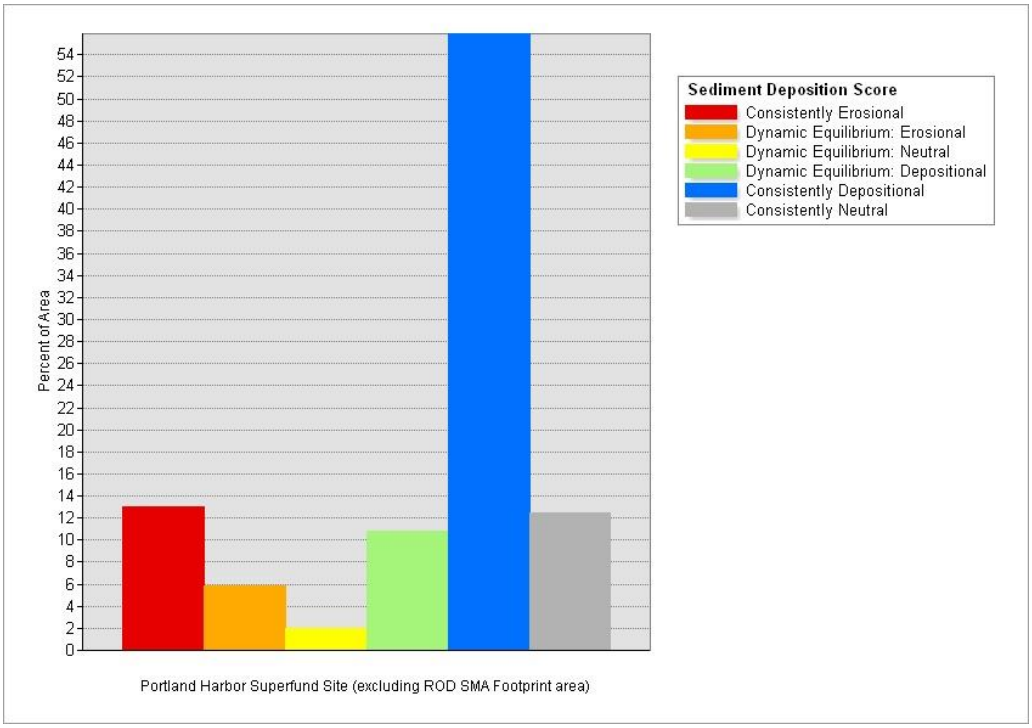


Figure 1. Sediment deposition histograms for a) the ROD SMA footprints and b) the remainder of the Site area.

The bathymetric change analysis suggests that the ROD SMA areas are 30 percent (%) consistently depositional with 70% that are erosional, neutral, or in dynamic equilibrium. Coupled with the high concentrations of focused COCs in these areas, monitored natural recovery (MNR) will not be successful. The results with these new data agree with the evaluations performed during the Feasibility Study (FS) and ROD (EPA 2016, 2017). The areas outside of the ROD SMAs (i.e., remaining Site area) where MNR is the selected technology are 56% consistently depositional with 44% that are erosional, neutral, or in dynamic equilibrium. Additionally, these areas do not have focused COC concentrations greater than RALs and therefore MNR should be successful. **Supplemental Figure S1** shows the spatial distribution of depositional and erosional areas.

The 2004 and 2018 bathymetric surveys were also directly compared to understand the absolute change in sediment bed elevation during this time. The 2004 and 2018 surveys occurred just before comprehensive surface sediment sampling events during the RI and PDI, respectively. Therefore, these two surveys represent the most appropriate points for direct comparison. The results suggest that sediment deposition is not evenly distributed throughout the ROD SMAs. **Figure 2** shows the amount of net deposition in cubic yards that the SMAs (broken up by EPA Proposed Remedial Design Areas) received as well as the average thickness of this deposited sediment. **Supplemental Figure S2** shows the spatial distribution of deposition and erosion from 2004 to 2018.

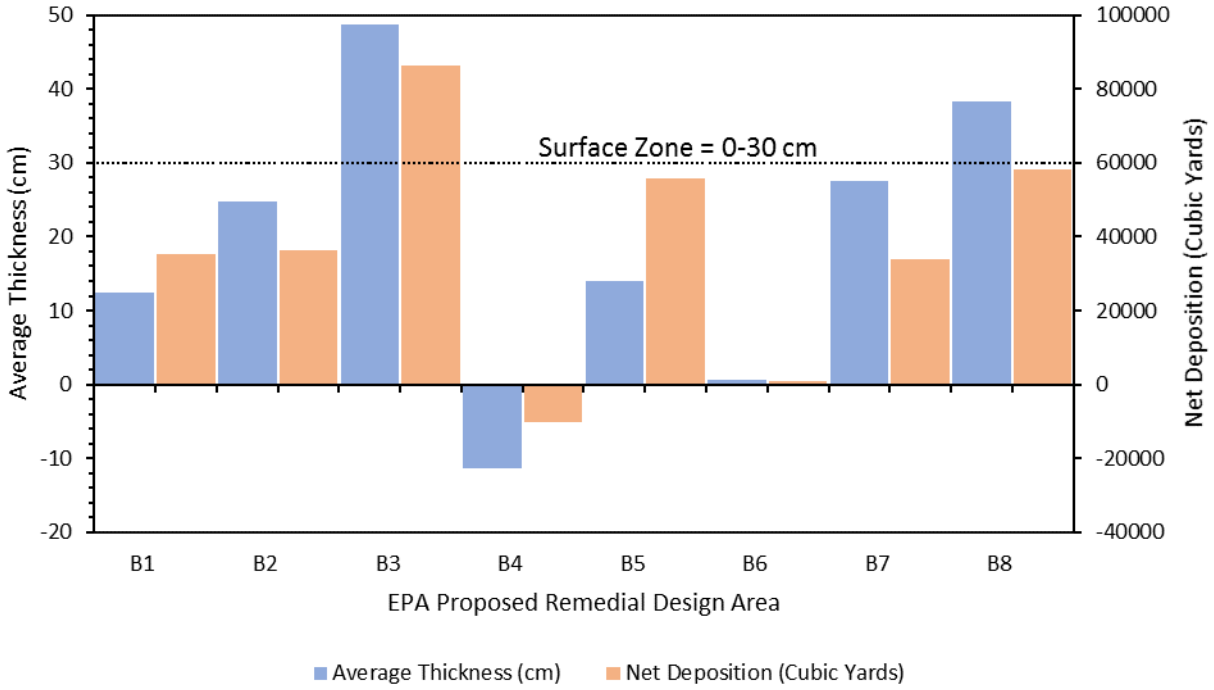


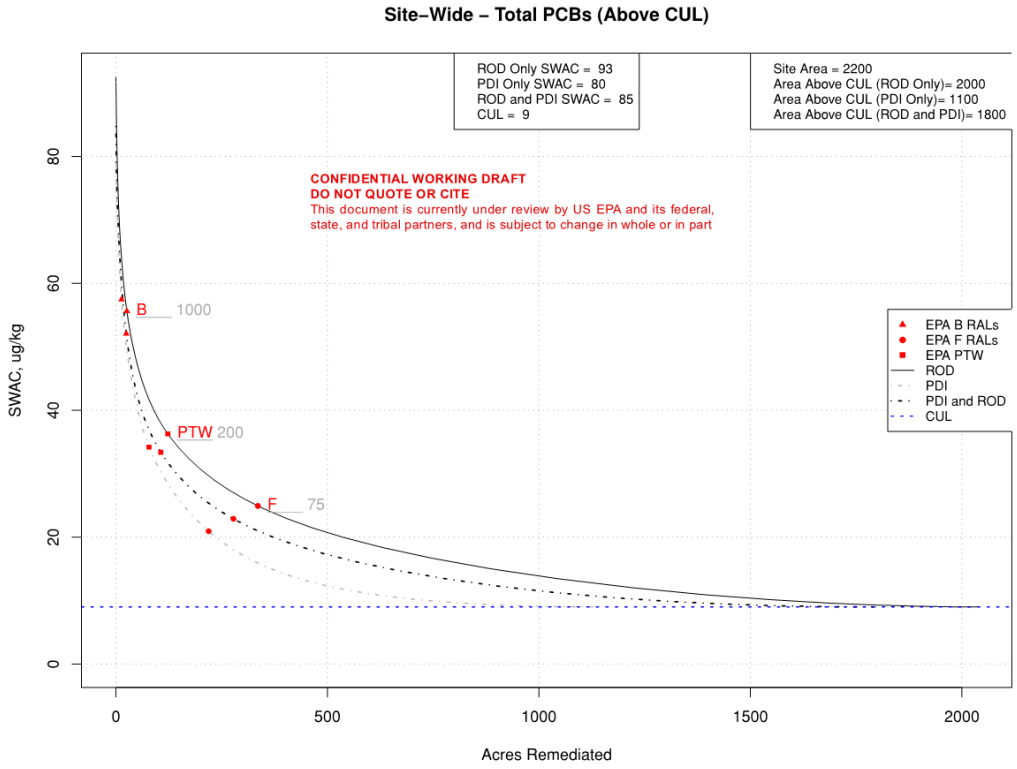
Figure 2. Average new sediment thickness and net sediment deposition in the ROD SMA footprints broken down by EPA Proposed Remedial Design Area.

Sediment deposition varies between areas in the ROD SMAs and ranges from -10,000 cubic yards (i.e., erosion) in the B4 area (RM 11E) to 87,000 cubic yards in the B3 area (RM 9W). This results in average sediment thicknesses of the deposited sediment that range from -12 centimeters (cm) to 49 cm (about 1.5 feet). The zone of surface sediment is defined as the top 30 cm of the sediment bed and only two proposed design areas (B3 and B8) received sediment deposition greater than surface depth thresholds over a 14-year period from 2004 to 2018.

Updated Remedial Action Level Curves

In the ROD, the surface sediment data from the RI/FS were used to develop RAL concentrations for the six focused COCs. The RAL concentrations consider the amount of material that would be addressed to achieve contaminant and risk reductions throughout the Site. This is done with "RAL curve" plots which compare the number of acres remediated against the post-remediation surface area weighted average concentrations (SWACs). The ROD selected higher RALs for the navigation channel ("B" RALs) compared to the remaining Site area ("F" RALs) due to the disconnected exposure pathways in the deeper navigation channel (EPA 2017). Updated RAL curves for the focused COCs were developed with the 2018 PDI surface sediment data to determine whether the relationship between concentration and area remediated have substantially changed since the RI/FS data were collected. **Figures 3a** through **3f** show the RAL curves with data from the ROD only (solid line), PDI only (light dash line), and ROD/PDI combined datasets (dark dash line).

a)



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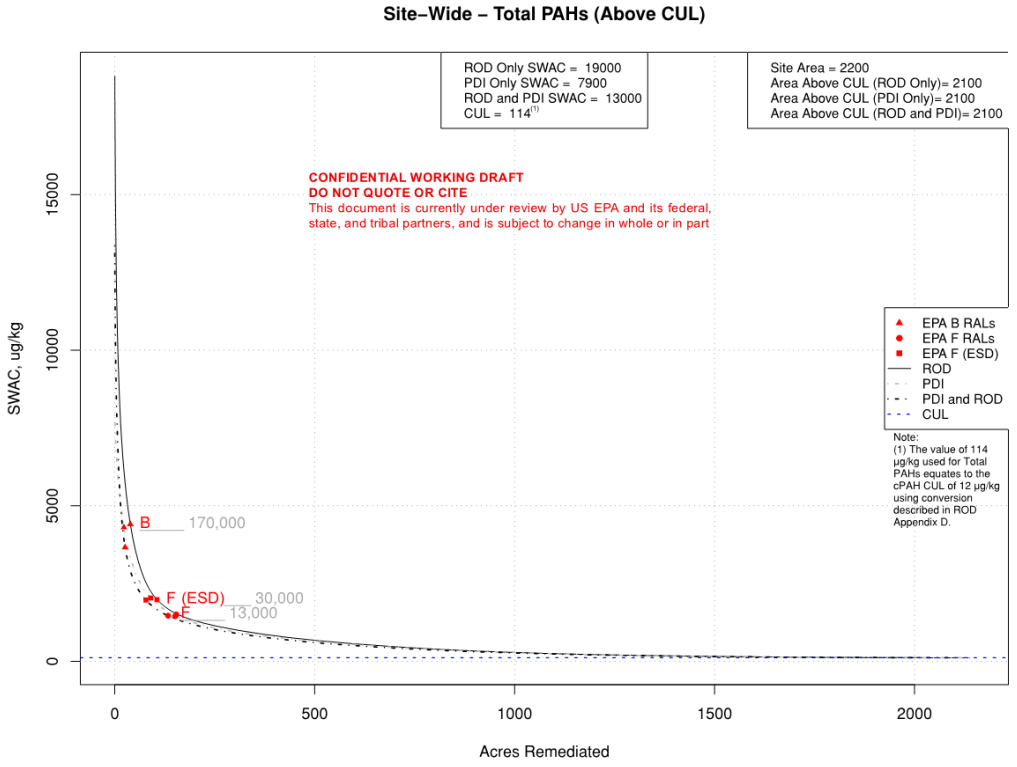

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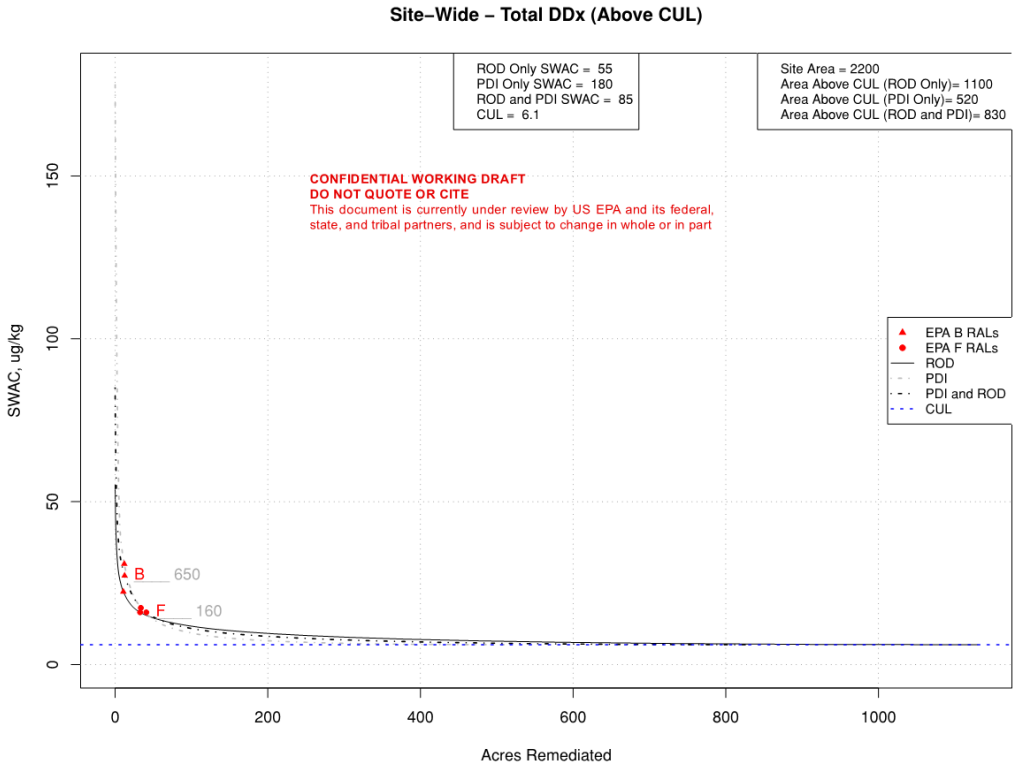

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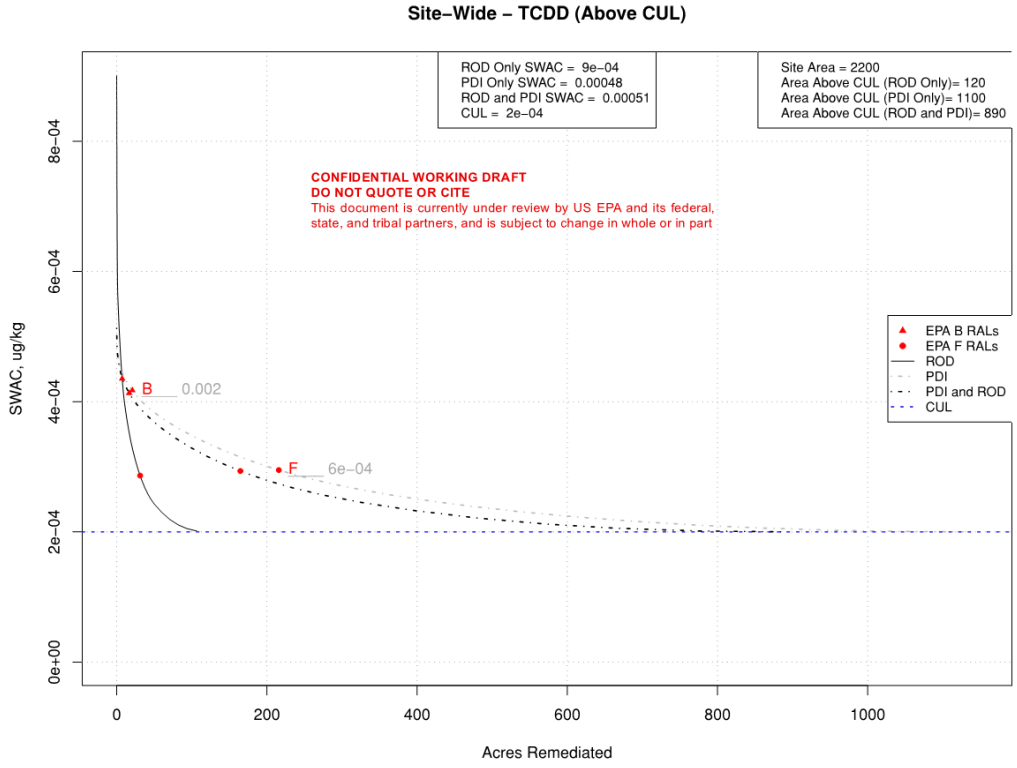

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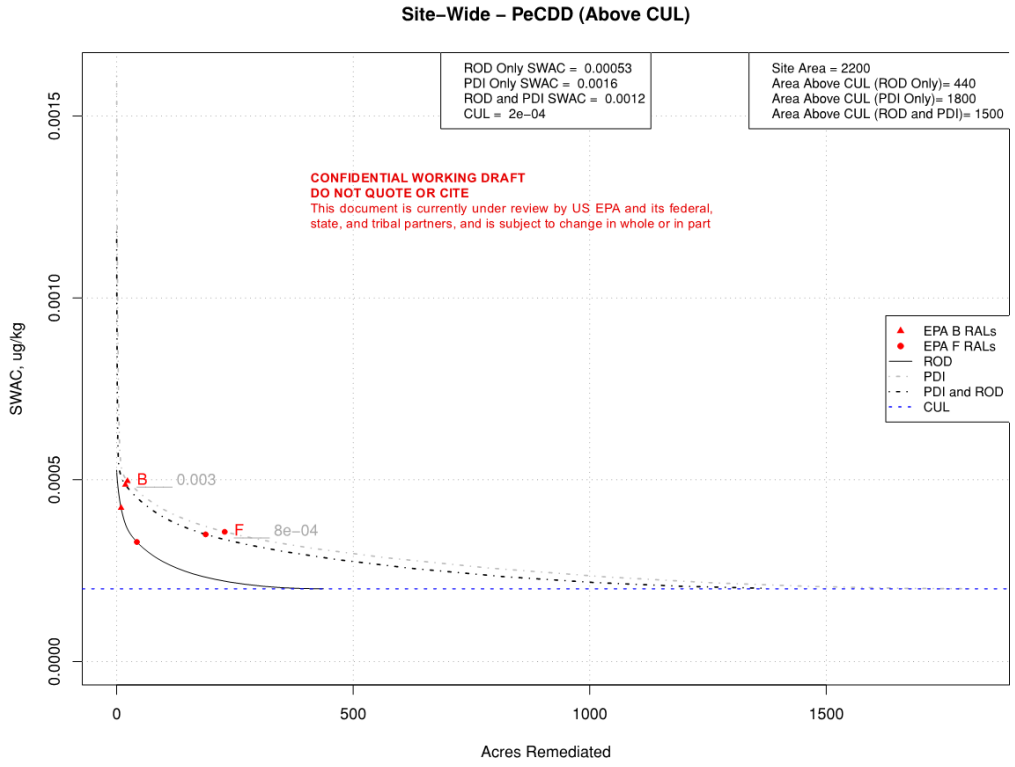

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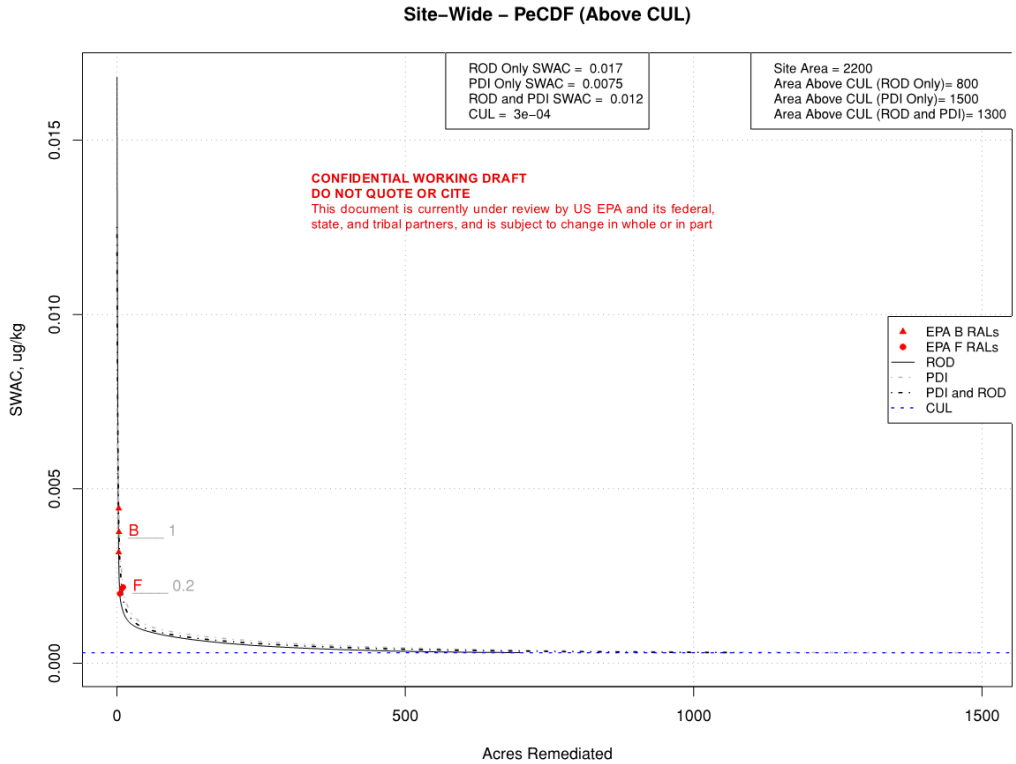

Figure 3. RAL curves for the six focused COCs a) total PCBs; b) total PAHs; c) DDx; d) 2,3,7,8-TCDD; e) 1,2,3,7,8-PeCDD; and f) 2,3,4,7,8-PeCDF. The figures show RAL curves for the RI/FS data (ROD), 2018 PDI data (PDI), and combined datasets (PDI and ROD). The navigation channel (i.e., B) and Site-wide (i.e., F) RALs are shown as red triangles and circles, respectively.

The updated plots with the 2018 PDI data show that the RAL concentrations for the focused COCs selected in the ROD[1] are still appropriate. The curves for total PAHs, DDx, and PeCDF indicate little change while those for TCDD and PeCDD show an increase in the area requiring active remediation. The area requiring active remediation for total PCBs appears to have decreased; however, the F RAL is still appropriate for substantial risk reduction in the nearshore areas without experiencing diminishing returns. The curves for the three datasets (ROD; PDI; ROD and PDI) are generally similar but do contain differences. These differences are due to the 10-15 years between the ROD and PDI data collection and a more complete Site-wide sampling for dioxins/furans performed in 2018.

Summary and Conclusions

Seventy percent of the ROD SMAs are erosional, neutral or in dynamic equilibrium compared with 44% of the remaining Site area. Therefore, MNR will not sufficiently reduce risk in the SMAs where active remediation is required. The PDI data indicate that the RALs selected in the ROD are still appropriate and for natural recovery to be effective these hot spot areas need to be remediated. It is necessary to proceed into remedial design and remedial action to remediate these areas.

References

EPA. 2017. *Record of Decision.* Portland Harbor Superfund Site, Portland, Oregon. U.S. Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2016. *Portland Harbor RI/FS, Feasibility Study.* U.S. Environmental Protection Agency Region 10, Seattle, Washington. June.

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[1] The Proposed Explanation of Significant Differences (ESD) proposes increasing the Site-wide RAL for total PAHs from 13,000 µg/kg to 30,000 µg/kg based on updated risk and toxicity information in the EPA Integrated Risk Information System.